

In the Claims:

Please cancel claims 2-4, 6, and 17. Also, please rewrite claims 1, 5, 7, 10, 21, and 30 as indicated below:

Sub
J1
a1

1. (amended) A peptide nucleic acid conjugate comprising:
a peptide nucleic acid;
said peptide nucleic acid having a backbone;
said backbone having an amino end, a carboxyl end, [and] a plurality of amino groups, and a conjugate bound directly or through a linking moiety to at least one of said amino end or said carboxyl end;
said amino groups each having a tethered nucleobase; and
[a conjugate bound to said peptide nucleic acid either directly or through a linking moiety.]
said conjugate being a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator.

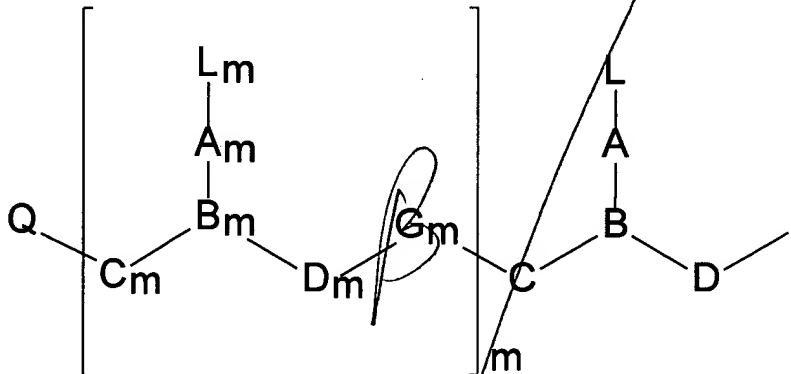
Sub
J2
a2

5. (amended) A peptide nucleic acid conjugate [of claim 1 wherein] comprising:
a peptide nucleic acid;
said peptide nucleic acid having a backbone;
said backbone having an amino end, a carboxyl end, and a plurality of amino groups;

Q2 cont

said amino groups each having a tethered nucleobase and a [said] conjugate [is] bound to said nucleobase or said tether either directly or through a linking moiety, wherein said conjugate is a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers.

7. (amended) A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer [integer] from 1 to about 50;

L and L_m independently are R¹²(R¹³)_a [;] wherein:

R¹² is hydrogen, hydroxy, (C₁-C₄)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a

nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

C and C_m independently are $(CR^6R^7)_y$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 , SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

wherein R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl; and

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;

D and D_m independently are $(CR^6R^7)_z$;

each of y and z is zero or an integer from 1 to 10, wherein the sum $y + z$ is greater than 2 but not more than 10;

G_m is independently $-NR^3CO-$, $-NR^3CS-$, $-NR^3SO-$, or

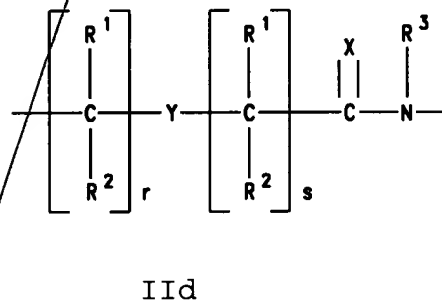
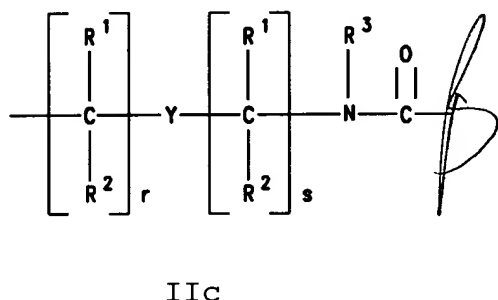
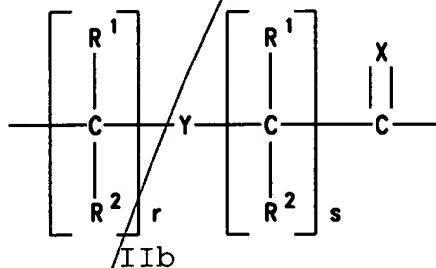
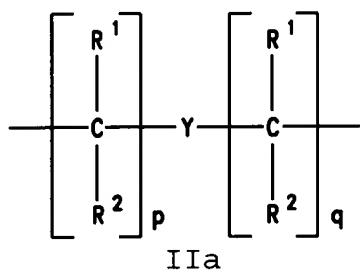
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$-\text{NR}^3\text{SO}_2-$ in either orientation;

each pair of A-A_m and B-B_m are selected such that:

(a) A or A_m is a group of formula (IIa), (IIb) or (IIc) and B or B_m is N or R^3N^+ ; or

(b) A or A_m is a group of formula (IId) and B or B_m is CH ;



wherein:

X is O , S , Se , NR^3 , CH_2 or $\text{C}(\text{CH}_3)_2$;

Y is a single bond, O , S or NR^4 ;

each of p and q is zero or an integer from 1 to 5; [, the sum $p+q$ being not more than 10;]

each of r and s is zero or an integer from 1 to 5; [, the sum $r+s$ being not more than 10;]

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{--}\text{C}_4)$ alkyl, hydroxy-substituted $(\text{C}_1\text{--}\text{C}_4)$ alkyl, alkoxy-substituted $(\text{C}_1\text{--}\text{C}_4)$ alkyl, alkylthio-

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substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR⁸R⁹ or -NR¹⁰C(O)R¹¹; wherein:

R⁸, R⁹, R¹⁰ and R¹¹ independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is -CO₂H, -CO₂R⁸, -CO₂R⁹, -CONR⁸R⁹, -SO₃H, -SO₂NR¹⁰R¹¹ or an activated derivative of -CO₂H or -SO₃H; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A_n, L, and L_n comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

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3
A1
cont

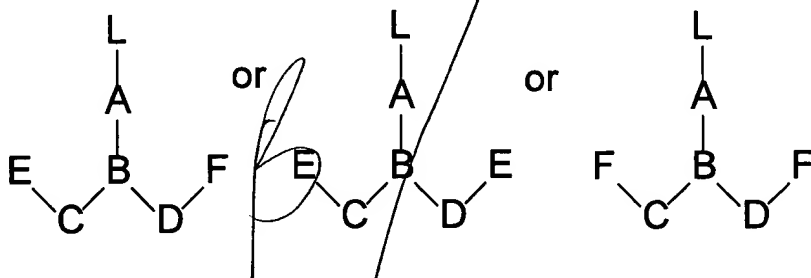
[R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R¹⁰, R¹¹, R¹² and R¹³ is a conjugate wherein said conjugate is a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, an aromatic lipophilic molecule, a non aromatic lipophilic molecule, a phospholipid, an intercalator, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA cleaving complex, a metal chelator, a porphyrin an alkylator, or a polymeric compound selected from polymeric amines, a polymeric glycols and polyethers; and]

wherein said conjugate optionally includes a linking moiety.

B
A4
SUB
G4

10. (amended) A peptide nucleic acid conjugate of claim 37 wherein at least one of L and L_m is R¹²(R¹³)₁ [group R¹³] is a conjugate.

21. (amended) A compound having one of the following formulas:



wherein:

L is R¹²(R¹³)_a; wherein:

AS cont

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

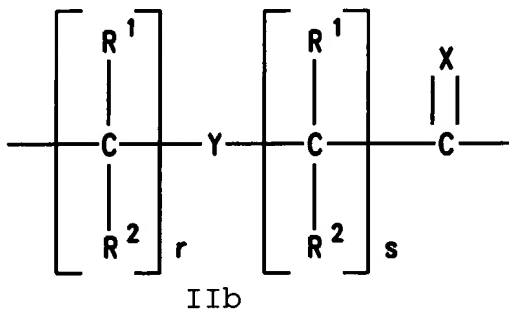
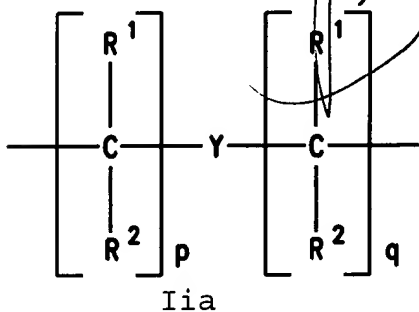
R^{13} is a conjugate; and

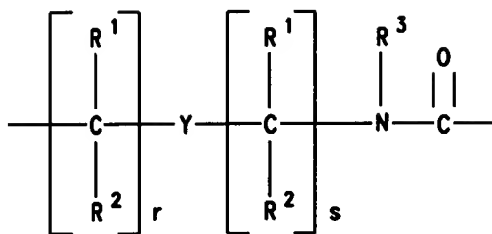
a is 0 or 1;

A and B are selected such that:

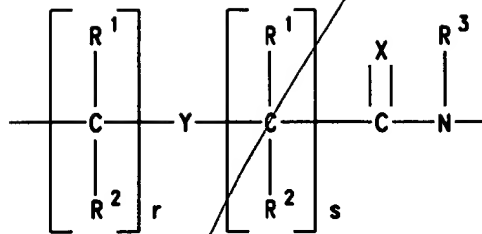
(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;





IIc



IIId

where:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR⁴;

p and q independently are zero or an integer from 1 to 5; [the sum p+q being not more than 10;]

r and s independently are zero or an integer from 1 to 5; [the sum r+s being not more than 10;]

R¹ and R² independently are hydrogen, (C₁-C₄)alkyl, hydroxy-substituted (C₁-C₄)alkyl, alkoxy-substituted (C₁-C₄)alkyl, alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR⁶R⁷)_y;

D is (CR⁶R⁷)_z; wherein:

R⁶ and R⁷ independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C₂-C₆) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C₁-C₆) alkoxy, (C₁-C₆) alkylthio, a conjugate, NR³R⁴ and SR⁵ or R⁶ and R⁷

taken together complete an alicyclic or heterocyclic system;

R³ and R⁴ independently are hydrogen, a conjugate, (C₁-C₄)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio or amino; and R⁵ is hydrogen, a conjugate, (C₁-C₆)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C₁-C₆)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, OSOH, SOOH, SO₂OH or an activated or protected derivative thereof;

F independently is NHR³ or NPgR³, where Pg is an amino protecting group; [and

at least one of R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R¹², and R¹³ is a conjugate wherein said conjugate is a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, an aromatic lipophilic molecule, a non aromatic lipophilic molecule, a phospholipid, an intercalator, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA cleaving complex, a metal chelator, a porphyrin an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and]

wherein:

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water

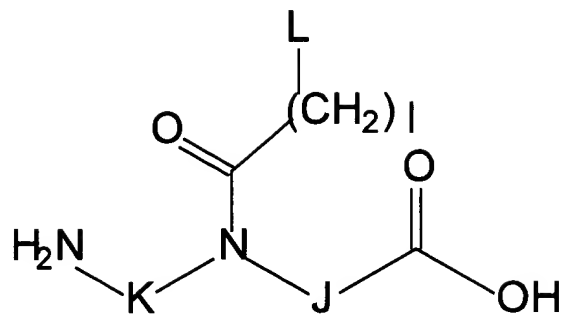
soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

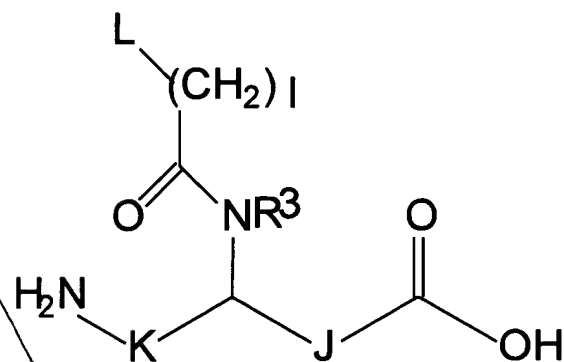
wherein said conjugate optionally [includes] includes a linking moiety.

30. (amended) A peptide nucleic acid conjugate ~~comprising a~~ ^{oligomer comprising a} ~~plurality of~~ ^{plurality of covalently linked} PNA monomers wherein at least one of said PNA monomers has the formula:

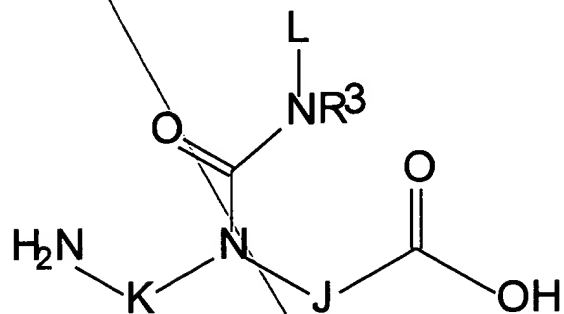
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*Ab
cont*
or formula:



or formula:



wherein:

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Ab
cont
L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

K is $(CR^6R^7)_z$;

J is $(CR^6R^7)_y$; wherein:

R^6 and R^7 are independently hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;

R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

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each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

at least one of L and R^3 comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; ~~and compare~~

[R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^{12} , and R^{13} is a conjugate wherein said conjugate is a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, an aromatic lipophilic molecule, a non aromatic lipophilic molecule, a phospholipid, an intercalator, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA cleaving complex, a metal chelator, a porphyrin an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and]

wherein said conjugate optionally includes a linking moiety.